#1070-5

AQUATIC PLANT and ALGAE CONTROL

Ontario

Ministry of the Environment

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~ 1983-1985

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Aquatic plants including algae in a variety of forms are a natural part of a healthy aquatic ecosystem. They will grow wherever suitable sunlight, nutrients, and water quality conditions exist. As different plant species have different requirements, where these parameters vary a variety of ecological niches is produced and a mixed community of plants will coexist.

Aquatic plants are beneficial. They augment natural dissolved oxygen levels, bind available plant nutrients and provide food and habitat for 300 planktonic and other invertebrates. They provide protective cover for fish from their predators, and camouflage nesting sites. In addition, the seeds and tubers provide a source of food for waterfowl, and the foliage serves as shelter for amphibians, waterfowl and muskrats.

In excessive amounts, however, aquatic vegetation can have a detrimental effect on the ecosystem. Algal blooms or dense submerged plant communities can create such large daily oscillations in the dissolved oxygen levels in the water that fish may die. Furthermore, excessive plant cover can result in populations of severely stunted fish. In many recreational lakes in Ontario, dense stands of aquatic plants such as Eurasian water milfoil Myriophyllum spicatum pose a major deterrent to recreational use, particularly for activities such as swimming, boating and water skiing.

CLASSIFICATION OF PLANTS

1. Algae

The simplest plant forms that live in a water environment are the single-celled algae. These include silica-shelled diatoms and Euglena spp. Here, each cell is a complete plant in itself. Rapid increases in numbers occur by division of each cell, assuming that nutrients such as phosphorus and nitrogen are available. These may be introduced into the water naturally (through the decomposition of grass clippings, leaf matter, or large aquatic plants) or artificially (for example, the leakage of a faulty septic system, or the run-off and seepage from farm livestock operations).

Filamentous algae, in contrast, consist of series of cells joined end to end. As with the previous groups, these must be examined under a microscope for accurate identification. Common species of filamentous green algae such as Spirogyra sp., Mougeotia sp., and Ulothrix sp. sometimes occur in large amounts in fish, farm and golf course ponds early in the spring, but may die back naturally when the surface water temperature exceeds species tolerance. After an algicide application, the duration of control of nuisance filamentous algae varies with pond flushing rates and the potential for re-invasion from upstream sources. Cladophora sp., a branched filamentous green alga, is a problem in many beach areas of the Great Lakes, including Lake Huron, Lake Erie and Lake Ontario, where plant filaments growing on rocks underwater, often quite a distance from shore, are broken off and washed up on the beaches; decomposing debris often causes obnoxious odour problems.

Apart from green algae, both unicellular (Microcystis sp.) and filamentous (Aphanizomenon sp., Lyngbya sp. and Anabaena sp.) blue-green algae, may also develop into nuisance "blooms" where

suitable conditions occur. Microcystis sp. has been known to exist in concentrations high enough to cause death of cattle when contaminated water was used for livestock watering. This was due to an abnormally high concentration of the toxins which are secreted naturally by these cells, perhaps to inhibit establishment of competitive algal species.

One family of filamentous algae often mistaken for submergent vascular plants includes the muskgrass Chara spp. and stoneworts Nitella spp. In these plants the cells incorporate calcium carbonate from the water into the cell wall to give it rigidity. There is sufficient calcium carbonate that a white powder is left when the plants are removed from the water and dried. Chara is a problem in many hardwater trout ponds where it can grow, when unchecked, up to 3-4 m in length. Since it does not have a true vascular system and each filament fragment can regenerate a new plant, systemic herbicides, often mistakenly selected for use, do not work. Re-invasion, following fragmentation during mechanical removal, can also be a problem.

SUBMERGENTS

The second main category of aquatic vegetation, submergent plants, includes those which grow entirely below the surface of the water, with modified floating leaves on the surface and flower spikes and seedheads most often above it. In many lakes in the Kawartha-Trent system and the Rideau Lakes-Canal system, a community of mixed species is common: Water naiad Najas flexilis, narrow-leaf pondweeds, including Sago pondweed Potamogeton pectinatus, bassweed P. amplifolius, Richardson's pondweed P. richardsonii,Curly-leaf pondweed P. crispus, Canada water weed Elodea canadensis, coontail Ceratophyllum demersum, Water milfoil Myriophyllum spp. andTape grass Vallisneria americana. Where, in the past, susceptible species of submergents have been treated with herbicides, dominance in the plant community has shifted towards Tape grass.

EMERGENTS

Emergent plants, the third main category of aquatic vegetation, include those which grow on, or to a significant extent above, the water surface. Duckweed Lemna minor and L. trisulca is often a problem in permanent swamps and drainage ditches where water flow is minimal or nonexistent.

Emergent vegetation in roadside ditches, and in undeveloped areas around the edges of lakes and rivers, include bulrushes Scirpus sp., arrowhead Sagittaria sp., pickerelweed Pontederia sp., Water plantain Alisma sp., White water lily Nymphaea sp., Yellow water lily Nuphar sp., and cattails Typha sp. Best management can be achieved by integrating herbicide application with habitat alteration (e.g. dredging) to prevent re-invasion.

For all the above plant categories, water level fluctuations and seasonal variation in weather pattern as well as winter severity will cause a change in community species and density over time. It is, therefore, best to assume that in future years growth cannot be predicted 100% and, instead, to watch for changes from year to year.

EURASIAN WATER MILFOIL
Myriophyllum spicatum

Many of today's problems in environmental management relate directly to the

presence of exotic imports. These are non-native plants or animals which have been introduced intentionally or accidentally by man.

In Canada, the best known aquatic invader is Eurasian water milfoil. This native of Europe and Asia was first found in 1902 in Chesapeake Bay, Maryland and has since spread throughout North America. Its first record in Canada is a specimen collected from Rondeau Bay Provincial Park in 1961. The plant was not widely recognized as a nuisance until the early 1970's when it became troublesome in the Kawartha Lakes, Ontario, in Quebec and in British Columbia.

Eurasian water milfoil is an extremely aggressive plant which reproduces largely by auto-fragmentation and soon crowds out the native plants. It can invade water from 1 to 10 metres deep. When the stems reach the surface, canopy formation occurs through profuse branching. In temperate climates the plant exhibits a rapid growth phase in early spring, generally reaching the water surface by mid to late June and causing severe interference with recreational use. Since it can thrive under a variety of environmental conditions, it is now widespread in Ontario, except in the soft-water Precambrian Shield Lakes.

PLANT IDENTIFICATION

With any pest, it is imperative that the problem is properly identified before a control method is selected. Information about the life history of the plant, methods of reproduction and dispersal also assists in defining the techniques that would be most effective in obtaining long-term control. The diagrams and plant descriptions on page 12-21 illustrate some of the more common species of aquatic vegetation in Ontario. If you have any doubts about the identity of your pest plants, package samples of each kind in a little water in separate plastic bags to prevent them drying out, and mail them to the Ministry of the Environment, Suite 100, 135 St. Clair Avenue West, Toronto, M4V 1P5. Alternatively, take them to 40 St. Clair Avenue West, 7th Floor, Toronto, or to your nearest Regional or District Office of the Ministry (see list on page 11).

CONTROL METHOD

There is no one simple answer to aquatic vegetation control. When considering weed control measures for lakes where aquatic plants interfere with recreational use, primary consideration should obviously be given to rectifying the main causes of the problem, e.g. reducing the amount of nutrient entering the water. However, the bottom sediments of many lakes contain very large amounts of nutrients available for future generations, without a substantial increase from elsewhere.

A wide range of control measures including habitat manipulation, biological control, mechanical harvesting and chemical control have been practised around the world with variable success. A careful assessment of various techniques, and the value of the presence or absence of aquatic plants in a particular situation, should be made before any attempt at control is undertaken.

HABITAT MANIPULATION TECHNIQUES

The objective of habitat manipulation is to alter one or more of the physical or chemical factors critical to plant growth.

Examples of these techniques include the use of dyes in the water column, and floating sheets of black plastic or other screening material on the water surface to reduce light penetration. Covering the lake bottom with 15 to 20 cm of sand is an effective method of physically altering the substrate. A sheet of dark heavy-duty construction polyethylene placed below the sand blanket will have the effect both of curtailing the transport of nutrients from the lake bottom and of preventing the sand from sinking into soft sediments. Dredging can be used to deepen a body of water and thus reduce the areas which can be colonized by plants. It can also remove nutrient-rich sediments and alter the texture of the substrate, particularly in areas where silting has covered sterile sand or gravel bottoms. While deep dredging appears to be an effective long-term control, it is prohibitively costly. A less costly method which has been used with variable success is overwinter drawdown. This technique consists of lowering the water levels to expose the plants to freezing and desiccation. Its use for Eurasian water milfoil control in the Kawartha Lakes has been reviewed in detail but found to be of questionable value due to:

a) The small amplitude (about 1.2 m);

b) The predominance of mixed plant communities in the shallow nearshore areas of the lakes. These communities are largely composed of annual plants which are resistant to this form of control;

c) The possibility of causing severe oxygen depletion with resultant fish kills during the winter months because of the shallow nature of the lakes.

BIOLOGICAL CONTROL METHODS

These involve the use of a biological agent to control an undesirable pest species. Such biological control is viewed by its proponents as an inexpensive alternative to the often costly methods of chemical or mechanical control. However, these biological agents (fish, pathogens, insects) are by necessity exotic imports and, in view of our past serious mistakes, there is a general reluctance to use these techniques on a wholesale basis.

One of the most publicized biological control agents for aquatic vegetation is the Grass carp Ctenopharyngodon idella. This fish was first imported to Arkansas in the early 1960's for research purposes. Due to carelessness, the fish escaped from captivity and has spread to several major river systems in the U.S.A. At this time, there is still considerable disagreement over the beneficial aspects of Grass carp and further importation has now been banned. Of major concern is the fact that, if the carp spawns in large numbers in North America, the possibility of massive destruction of aquatic vegetation could bring disaster to native fishes, invertebrates and waterfowl. The European carp and goldfish which have been introduced to North American waters, affect vegetation by uprooting plants while feeding on invertebrates in the detritus and by creating turbid water conditions through which sunlight cannot penetrate for plant photosynthesis. They are not herbivores and compete aggressively with trout and bass populations often to the point of eliminating them.

Waterfowl, including ducks and geese, may have beneficial effects in reducing the plant population; however, their

droppings are messy, and if they fall into the water they fertilize it to such an extent that algal population explosions may occur.

Plant pathogens represent another area which is being explored for potential biocontrol agents. It has been estimated that there are over 100,000 plant diseases, thus offering untapped reservoirs of viruses, bacteria, fungi, etc. as potential control agents.

Certain invertebrates, such as the aquatic snail Marisa cornuarietis, also hold some promise as biocontrol agents, but could become pests themselves since they are non-specific and could destroy beneficial plants. One insect species, the alligatorweed flea beetle Agasicles hygrophila holds much promise since it is specific to alligatorweed, a problem plant in the southern U.S.A.

Obviously, the use of biocontrol agents is still in its infancy and must be approached with caution to avoid the possibility of substituting one pest by another.

MECHANICAL CONTROL

Mechanical removal of nuisance vegetation represents one of the oldest techniques known to man. Equipment can range from chains dragged along the bottom to uproot vegetation, to small inexpensive boat-mounted cutters, and large sophisticated machines capable of cutting and collecting the plants for shoreline disposal. The use of mechanical methods for clearance of small areas (e.g. swimming beaches) is rather impractical since the use of small cutters or chains requires intensive manual labour to remove the vegetation from the water. Failure to remove the uprooted plants or cuttings can create oxygen depletion problems through decomposition of the vegetation, and encourage the spreading and re-rooting of plant fragments.

On the other hand, for large scale projects which use the larger automated machines, mechanical harvesting has been advocated as an environmentally sound approach. Vast quantities of plant material containing nutrients (e.g. nitrogen and phosphorus) can be removed from the waterways without significantly affecting the fisheries or the food web that the fish depend on.

For additional information on harvesting techniques, guidelines and equipment manufacturers contact the nearest Ministry of the Environment office.

CHEMICAL CONTROL

Chemical control, largely using herbicides developed for terrestrial weed control, has been a commonly used tool throughout North America for several decades. Since the mode of action of herbicides may be contact or systemic, plant susceptibility varies according to the nature of its growth and reproduction. There is, therefore, some degree of selectivity in herbicides which may be used in the aquatic environment, and the nature and extent of plant nuisance must be defined before any treatment can be used safely and effectively. It is important to realize that rather than cause a reduction of nutrients in the aquatic environment, herbicide use may cause a release of nutrients when the plants decompose, with consequent severe algal "blooms". On the whole, herbicides are best used for weed control in small plots where such pronounced secondary effects will not occur.

In Ontario, a permit system restricts excessive and indiscriminate use of herbicides. Herbicides that are authorized for use have been stringently tested for safety and efficacy, and must be specifically registered for aquatic use under the Pest Control Products Act by Agriculture Canada. Recommendations on aquatic herbicide usage are published annually in the Guide to Chemical Weed Control, OMAF publication #75 which can be obtained from the Agricultural and Industrial Chemicals Section in Toronto or the Regional Offices of the Ministry of the Environment (see page 11).

Not all species of aquatic vegetation in lakes can be controlled by currently registered herbicides. Muskgrass Chara spp., Tape grass Vallisneria americana and the filamentous green alga Cladophora spp. are three examples of aquatic plants that are resistant to herbicidal activity. When resistant and susceptible plant species combine to create a problem, an integrated management scheme must be sought, rather than one using pesticides alone.

PESTICIDES LEGISLATION

The Pesticides Act, Subsection 1 of Section 5 provides that no person shall engage in, perform or offer to perform a (water) extermination except under or in accordance with a licence of a prescribed class . . . unless exempt under the regulations. In essence, a water extermination licence (Class 1 or Class 3 endorsed) is required by anyone applying a pesticide to water for algae or aquatic plant control other than on his own domestic premises.

In addition, Subsection 2 of Section 7 provides that anyone performing a water extermination must be the holder of a permit issued by the Director (under the Act) unless exempt under the regulations. Thus, a person requires a permit for the use of an aquatic herbicide where the treated water will move from the site of application to a lake, stream or other public water course by any means other than by percolation through the soil. Any aquatic herbicide research conducted in Ontario, regardless of trial location, requires a permit.

For example, a cottage association proposing to control submergent aquatics in a bay or lake area fronting numerous cottages will require a licence and a permit. One cottager treating his own cottage frontage will require only a permit. A municipality treating drainage ditches for control of emergent vegetation in the fall, when the ditches contain no moving water, will require only a licence.

Further information concerning licence applications, training sessions and examination requirements can be obtained from the Agricultural and Industrial Chemicals Section, 135 St. Clair Avenue West, Toronto, or the Regional or District pesticides specialist (see list on page 11). The licencing system has the effect of educating people on the safe storage, handling, and use of a pesticide, and the impact of the chemical on the aquatic environment.

An aquatic nuisance control permit is issued for one year only and ensures that there will be no unreasonable infringements on the rights of other water users. It also makes certain that the substance applied will not be toxic to humans, fish, domestic animals, or wildlife. Through the permit system, the area of vegetation treated in any one lake is regulated so that important fisheries and other wildlife habitats will not be significantly affected. To obtain a permit for applying a chemical or other substance to control nui-

sance conditions in any area of water, an individual or commercial agency must submit pertinent information on an official application form, so that the nature of a project and possible consequences arising from it can be satisfactorily evaluated. These application forms may be obtained by writing the Ministry of the Environment, Agricultural and Industrial Chemicals Section, Suite 100, 135 St. Clair Avenue West, Toronto, Ontario, M4V 1P5, or to Regional or District Offices of the Ministry (see page 11).

An application should be submitted well in advance of the time that the chemical is to be applied. While every effort is made to process applications as quickly as possible, three weeks may be required for the issuance of a permit, since it is necessary to correspond with the appropriate District Office of the Ministry of Natural Resources concerning a proposed treatment, or actually to investigate the area.

The acquisition of a permit or a licence does not divest any individual or commercial applicator from the responsibility for any undesirable consequences arising from a treatment. Anyone applying any substance without the authority of a licence or permit, or who violates the terms and conditions provided in a permit, is guilty of an offence under the Pesticides Act and Regulations, and upon a summary conviction is liable to a fine.

All aquatic nuisance control permit applications are reviewed by the Ministry of the Environment regional pesticides officers and water resources staff and the local Ministry of Natural Resources fisheries biologist. If valid scientific reasons exist, the Director may deny the permit, or impose conditions. The permittee may appeal by contacting the Director and a hearing will be organized with the Environmental Appeal Board.

Since 1978, purchase of an aquatic herbicide for public water treatment cannot be made without prior receipt of a valid aquatic nuisance control permit. This tightening up of the availability of aquatic herbicides has served to eliminate those individuals who were previously indiscriminately using herbicides without proper authorization or at excessive rates. The general concept of "the more the pesticide the more effective the control" is NOT an environmentally safe use practice.

HERBICIDE CALCULATIONS

Herbicides are found in a variety of formulations: wettable powders, granules, emulsifiable concentrates, and suspensions. Any package of product purchased from a retail outlet contains filler as well as the active ingredient (technical material). Thus, in the case of Simmaprim 80W, 80% or 8 out of 10 kilograms of product will be the active simazine; in the case of Reglone A 20% w/v two kilograms of active diquat is contained in ten litres of product.

In all cases, the label should be consulted for effective registered rates. The pesticide may be applied on an area basis (usually so much per hectare), OR on a volume basis (usually so much per 1000 cubic metres). IT IS IMPERATIVE THAT ACCURATE MEASUREMENTS OF WATER VOLUME are made so that the correct amount of pesticide is applied.

CALCULATION OF WATER VOLUMES AND DOSAGE RATES

When control of submerged plants is attempted using liquid formulations, it is

essential to know the volume of water present in the area to be treated. The surface area must be calculated and the average depth should be determined by adequate sounding.

To determine, the volume and total weight of water in the area to be treated, the following procedure is used:

Length x width x average depth = Volume in cubic metres

Volume in cubic metres x 28.4 kgs. = Total weight of water
(0.027 cubic metre of water = 28.4 kg)

NOTE: If area is measured in acres, 1 acre =3920.4 sq.m.

Effective concentrations of a herbicide or algicide are expressed as so many parts of active chemical per million parts of water on a weight per weight basis. Many chemicals are not sold in a pure state but are marketed as water or oil-base solutions or are impregnated in granules of inert materials. Therefore, it is imperative to know the percentage of pure active ingredient(s) in the product to be used. This information is provided on the label of the container in which the chemical is sold.

Recommended concentrations, expressed as parts per million (one kilogram of active chemical per million kilograms of water = 1 ppm) are usually provided by the manufacturers or suppliers of control products.

The following formula is used to calculate the number of kilograms of active chemical required:

(Total weight of water in kilograms x recommended concentration of active chemical in ppm) ÷ 1,000,000

Example: Calculate the number of kilograms of 20% active chemical which are required to treat the plot illustrated below, at a concentration of 2 ppm.

1m ----------1m ----------1m ------------1m
1.5m --------1.5m --------2m ------------2m
2m ----------2m ----------2.5m --------2.5m 25m
2.5m --------2.5m --------3m ------------4m
←-------------------33m -------------------→

*The varying depths in the above diagram are indicated by the different numbers.

The average depth of the plot is obtained by adding together all of the determined depths and then dividing by the number of depth measurements taken.
i.e. 1+1+1+1+1.5+1.5+2+2+2+2+2.5 +2.5+2.5+2.5+3+4m÷16 = 2.0m

Total area = 33m x 25m = 825 square metres

Average depth = 2.0 metres

Total water weight = 825 x 2.0 x 28.4 = 26,860 kgs.

Applying the formula:

Total weight of water x recommended concentration of active chemical in ppm ÷ 1,000,000 = (46,860 x 2) ÷ 1,000,000 = 0.094 kilograms of active chemical

However, since this particular material is only 20% active, 0.094 x 100 ÷ 20 = 0.47 kgs. of the commercial product would be required.

Aquatic nuisance control permit applications and other information regarding herbicides used for aquatic vegetation control can be obtained through the regional offices of the Ministry of Natural Resources; the Agricultural and Industrial Chemicals Section, Ministry of the Environment, Toronto, (416-965-2401), or the Regional or District Offices of the Ministry of the Environment (see page 11).

CAUTION:

When using aquatic herbicides, please be sure to read the label carefully.

ONTARIO MINISTRY OF THE ENVIRONMENT
PESTICIDES CONTROL FIELD OFFICES

DISTRICT	TELEPHONE
H. E. Collins P.O. Box 237, 435 Grand Ave. W. Chatham, N7M 5K3	519-352-5107
D.C. Morrow & W. Lampman 985 Adelaide Street South London, N6E 1V3	519-681-3600
J. Percy Ontario Govt. Bldg. 119 King Street West Hamilton, L8N 3Z9	416-521-7640
R. Miller Ontario Govt. Bldg. 119 King Street West Hamilton, L8N 3Z9	416-521-7640
B. T. Lobb P.O. Box 688 Ont. Ministry of Agr. & Food Bldg. Clinton, N0M 1L0	519-482-3428
W. Cowie 12 Fairview Road Barrie, L4N 4P3	705-726-1730
T. O'Neill & D. Trenholm 150 Ferrand Drive, Suite 700 Don Mills, M3C 1H6	416-424-3000 (Ext. 204)
A. G. Carpentier 139 George Street Peterborough, K9J 3G7	705-743-2972
D.A. Raddon 133 Dalton Street Kingston, K7Z 4X6	613-549-4000 613-521-3450
R.P. Cameron 2378 Holly Lane, Suite 204 Ottawa, K1V 7P1	
D.J. Mewett Northgate Shopping Centre 1500 Fisher Street North Bay, P1B 2H3	705-476-1001
P. McCubbin 83 Algonquin Blvd. West Timmins, P4N 4R4	705-264-9474
G.R. Gammond Ontario Government Building 435 James Street South Thunder Bay "F", P7E 6E3	807-475-1305
Head Office 135 St. Clair Avenue West Suite 100 Toronto, Ontario, M4V 1M2	416-965-2401

FILAMENTOUS ALGAE

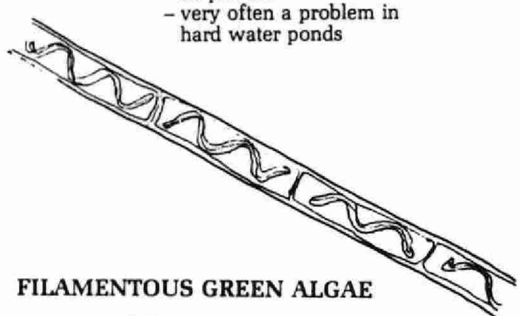
PLANT-LIKE ALGAE

MUSKGRASS

Chara vulgaris

½ - 1 x *actual size*

- can grow up to 4 metres in length
- lime green - grey green
- rough, coarse, gritty to the touch
- strong musk odour
- dries to white powder when removed from water
- attached to the bottom
- usually less than 0.75 metres high
- orange fruiting bodies may be present
- very often a problem in hard water ponds

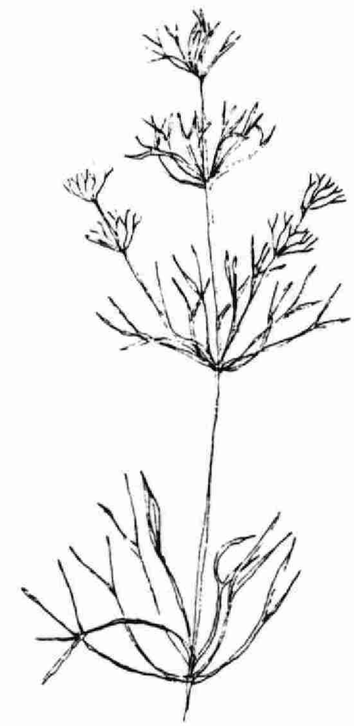


FILAMENTOUS GREEN ALGAE

Spirogyra sp.

125 - 250 x actual size

- green hair-like filaments
- slimy to touch
- often attached to rocks

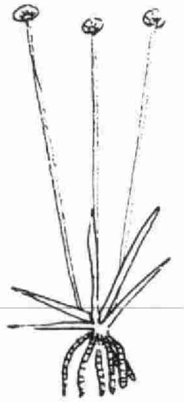


STONEWORT

Nitella sp.

3 x actual size

- much like Chara but smooth to the touch
- does not dry to a white powder when removed from water

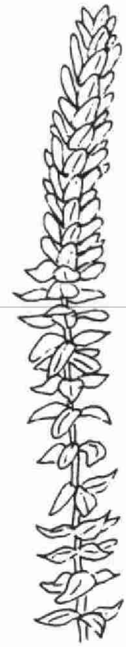


PIPEWORT

Eriocaulon sp.

½ x actual size

- leaf rosette about 8 cm. diameter
- button-like white flowers on straight stalk above surface of water
- fibrous white root



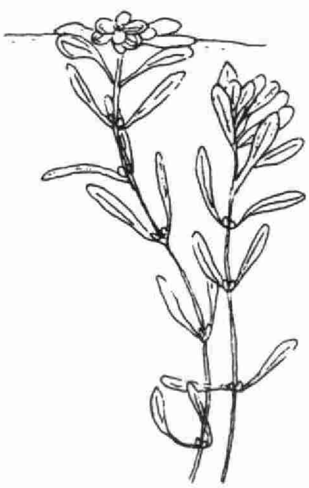
CANADA WATER WEED

Ancharis canadensis

(ELODEA)

actual size

- *may or may not be rooted*
- *entirely submerged except in flower (white or pink)*
- *stem often branched*
- *base of leaf embraces stem*
- *clusters of 4 small leaves around main stem*
- *leaf margin has microscopic teeth*

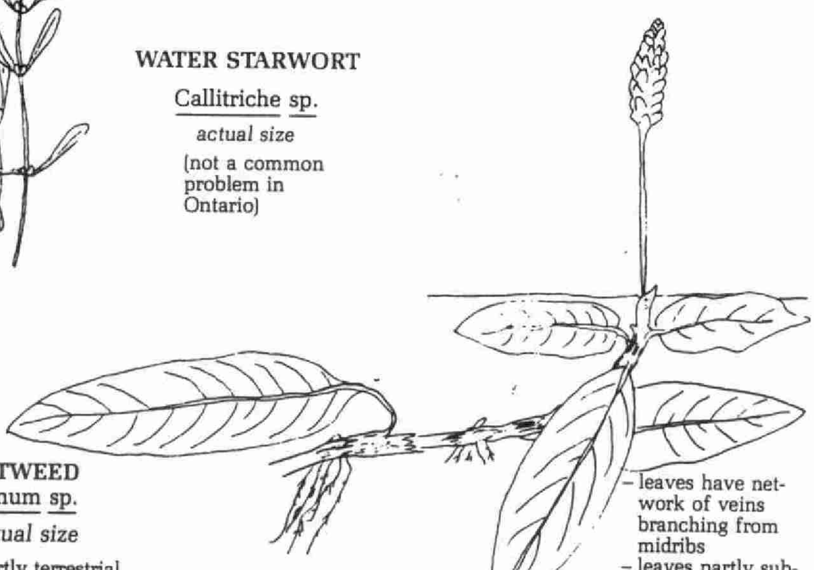


WATER STARWORT

Callitriche sp.

actual size

(not a common problem in Ontario)



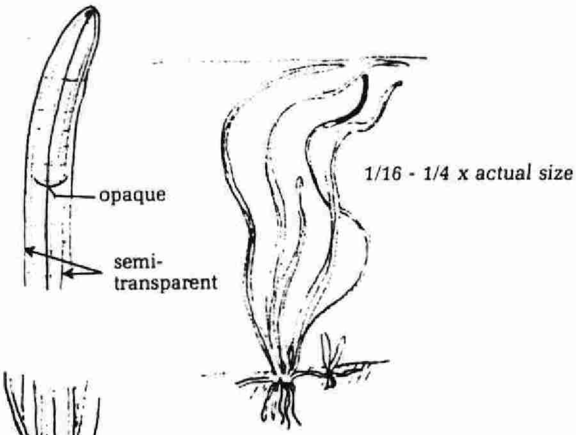
SMARTWEED

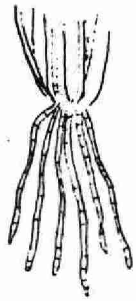
Polygonum sp.

½ x actual size

- may be partly terrestrial
- bright pink flower above water surface

- leaves have network of veins branching from midribs
- leaves partly submerged with only flower above water surface





actual size

TAPE GRASS (WILD CELERY)

Vallisneria americana

- leaves ribbon-like, up to one metre or more in length
- short flared root
- tiny white flower at surface on coiled stem
- long pod-shaped fruiting body
- new plants grow at nodes along buried stems

WATER MILFOIL

Myriophyllum sp.

actual size

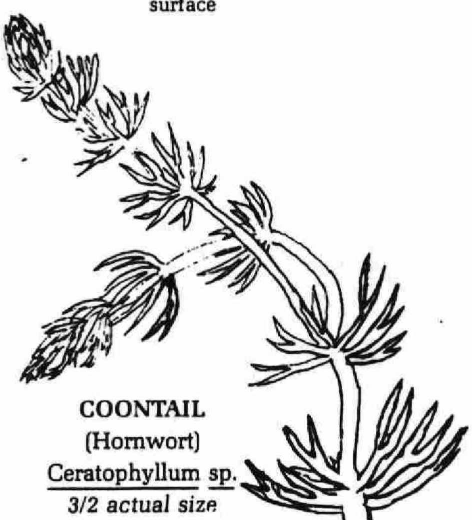
- four feathery leaves at each stem nod
- each leaf symmetrically subdivided
- many stems from 1 root; stems may be branching
- there are a number of native and exotic species
- small flowers in spikes above water surface

BLADDERWORT

Utricularia vulgaris

actual size

- asymmetrical branching
- tiny bladders easily recognizable
- can grow as long as 0.5 metre



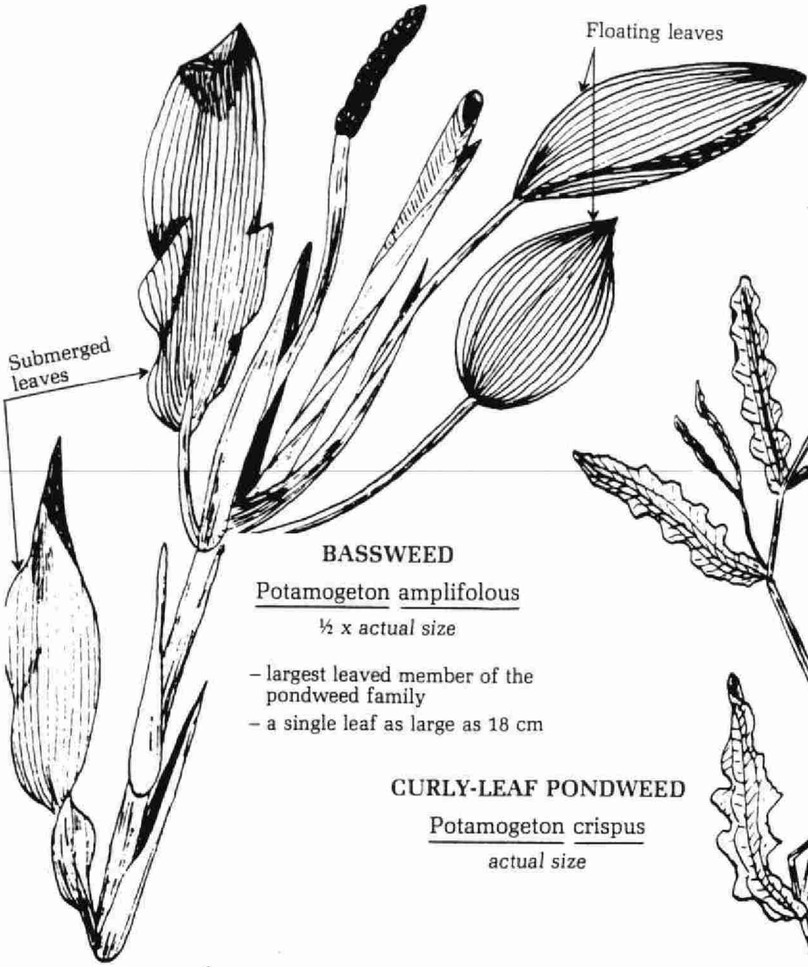
COONTAIL

(Hornwort)

Ceratophyllum sp.

3/2 actual size

- plants entirely submerged, no roots, sometimes stem is embedded in the muddy bottom
- paired leaflets grouped at regular intervals along stem
- stem may be branched
- usually heavy concentrations of leaflets at apex



BASSWEED

Potamogeton amplifolous

½ x actual size

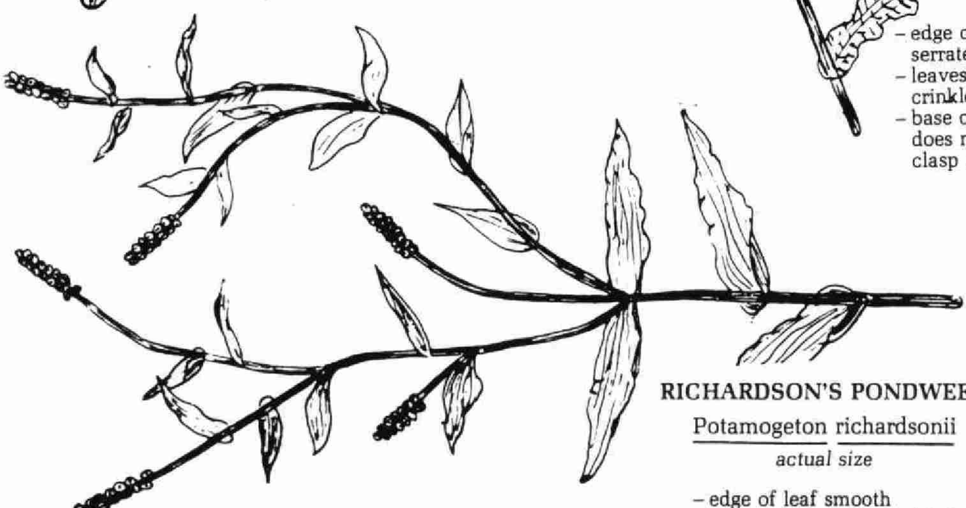
- largest leaved member of the pondweed family
- a single leaf as large as 18 cm

CURLY-LEAF PONDWEED

Potamogeton crispus

actual size

- edge of leaf serrated
- leaves strongly crinkled
- base of leaf does not clasp stem



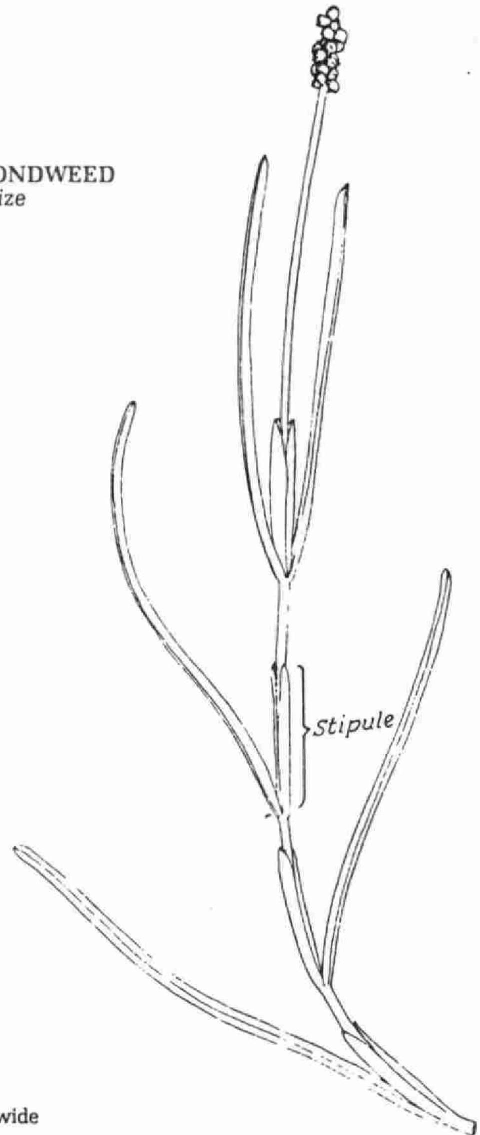
RICHARDSON'S PONDWEED

Potamogeton richardsonii

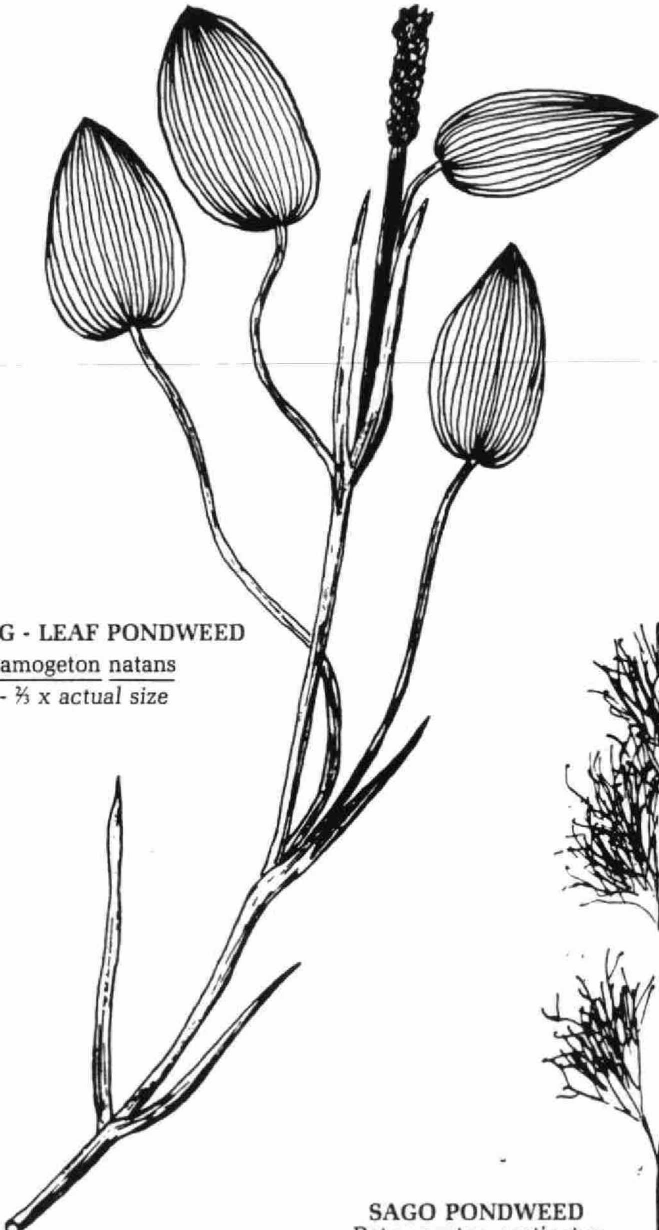
actual size

- edge of leaf smooth
- leaves moderately crinkled
- base of leaf clasps stem

FLAT-STEMMED PONDWEED
½ x *actual size*



- main leaves ribbon-like and long; 1-3mm wide
- stem many-branched
- stripules delicately reined either green or white

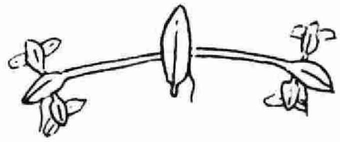


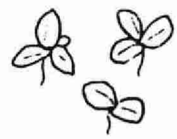
FLOATING - LEAF PONDWEED
Potamogeton natans
½ - ⅔ x actual size

- oval brownish-green leaves float on water surface
- leaves heart-shaped at base
- flower spike usually above water surface

SAGO PONDWEED
Potamogeton pectinatus
½ x actual size

- leaf tips with long tapering points
- numerous thread-like leaves spread in fan-like fashion from stem
- found primarily in hard or brackish water or slow moving streams



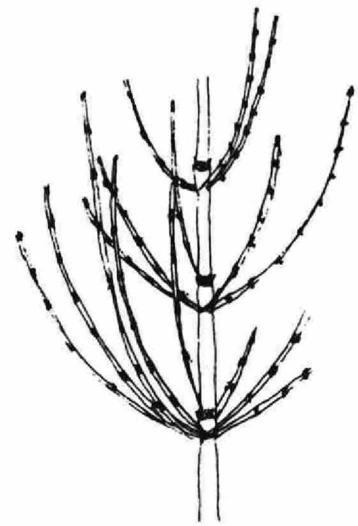


DUCKWEED
Lemna sp.

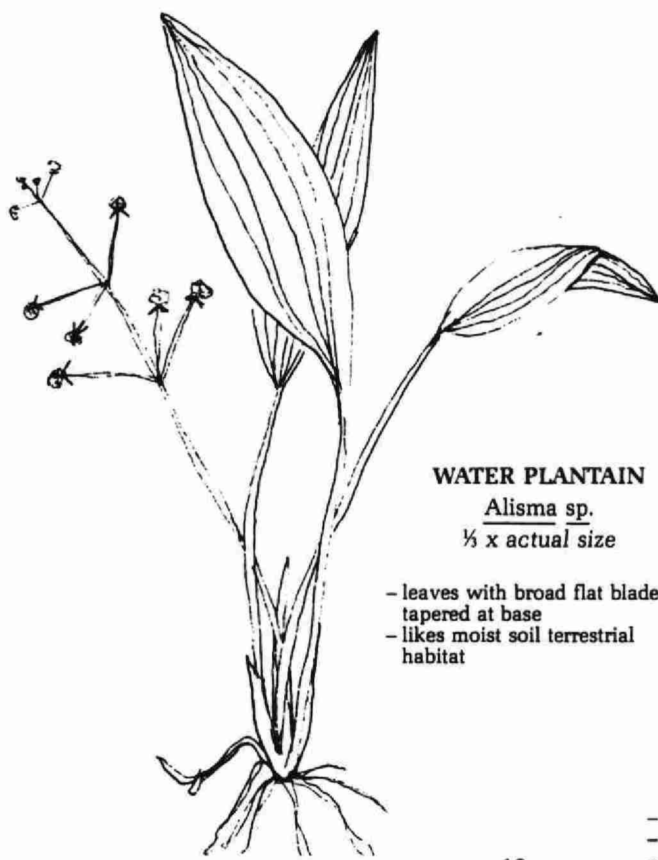
3 - 4 x actual size

- floats at or near surface of water
- hair-like roots may dangle below foliage

HORSETAIL
Equisetum sp.
½ x actual size

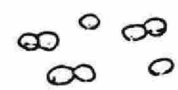


- stems hollow and pointed
- no true leaves but a whorl of slender branches from each joint



WATER PLANTAIN
Alisma sp.
⅓ x actual size

- leaves with broad flat blades, tapered at base
- likes moist soil terrestrial habitat



WATERMEAL
Wolffia sp.
4 x actual size

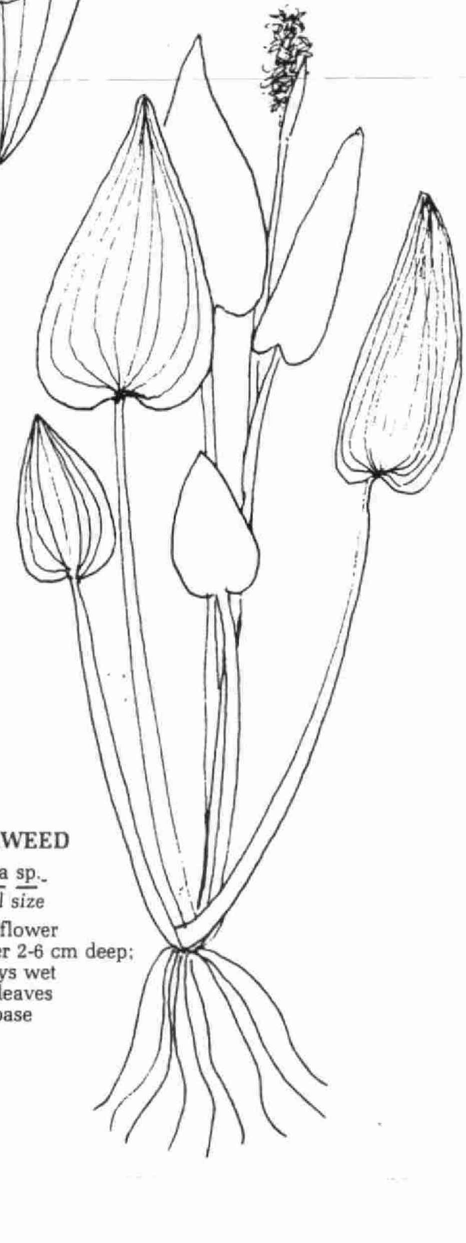
- floating on or near surface of water
- no roots
- microscopic meal-like (globular) bodies

ARROWHEAD

Sagittaria latifolia

⅓ - 1 x actual size

- veins several, of equal length
- root system very prominent and thick
- arrowhead shaped leaves
- tiny white flowers
- likes moist terrestrial environment edging lakes and marshes

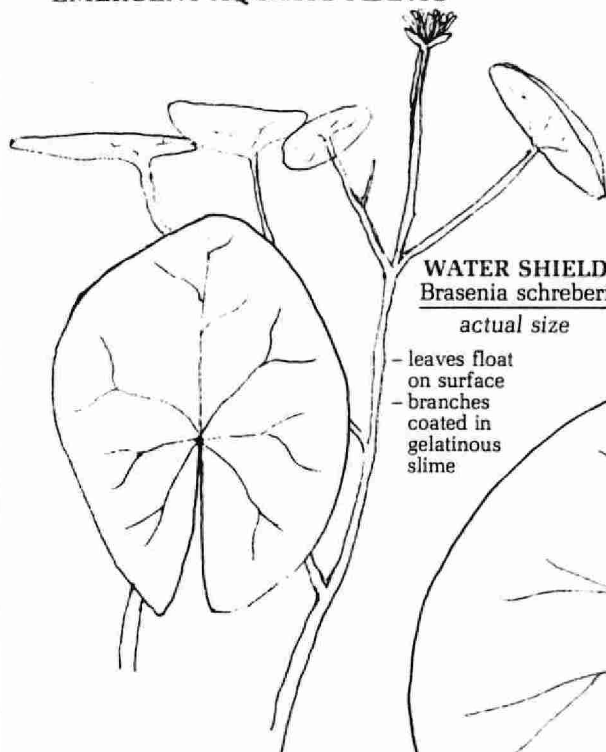


PICKERELWEED

Pontederia sp.

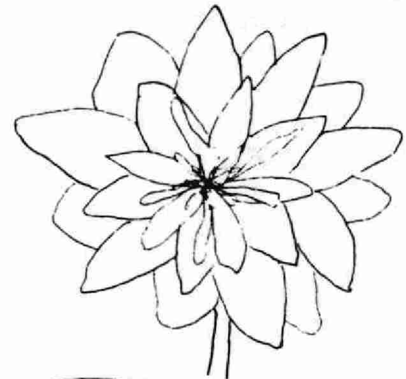
¼ x actual size

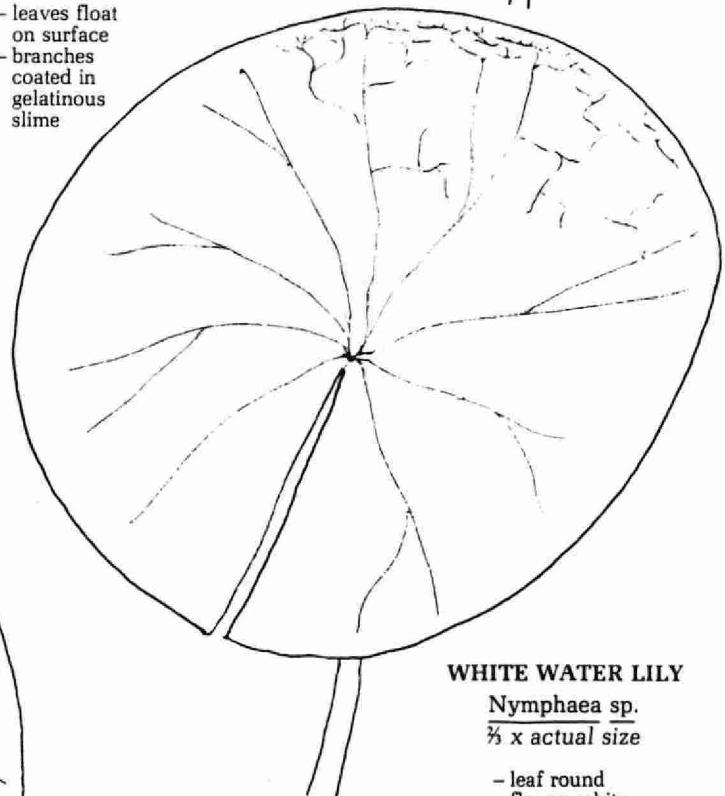
- bright purple flower
- found in water 2-6 cm deep; must be always wet
- heart-shaped leaves extend from base



WATER SHIELD
Brasenia schreberi
actual size

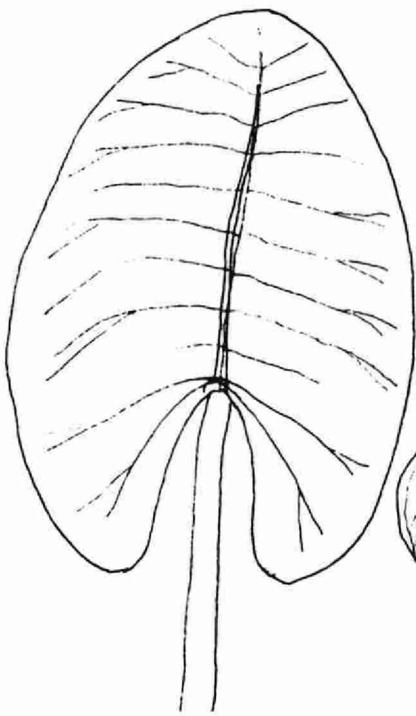
- leaves float on surface
- branches coated in gelatinous slime

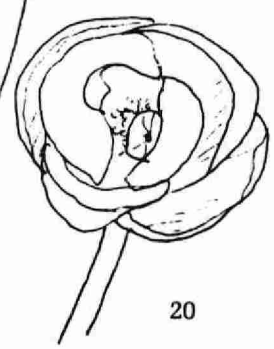




WHITE WATER LILY
Nymphaea sp.
⅔ x *actual size*

- leaf round
- flower white

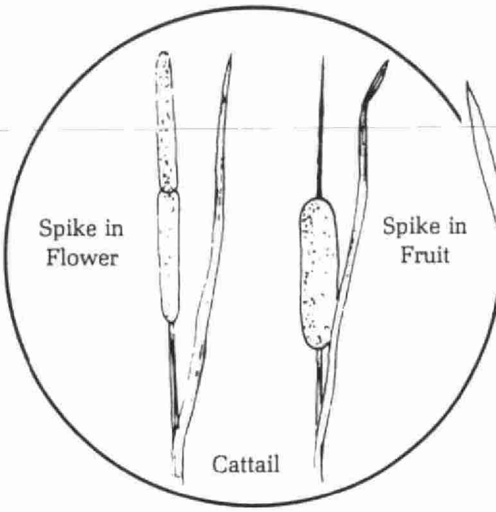


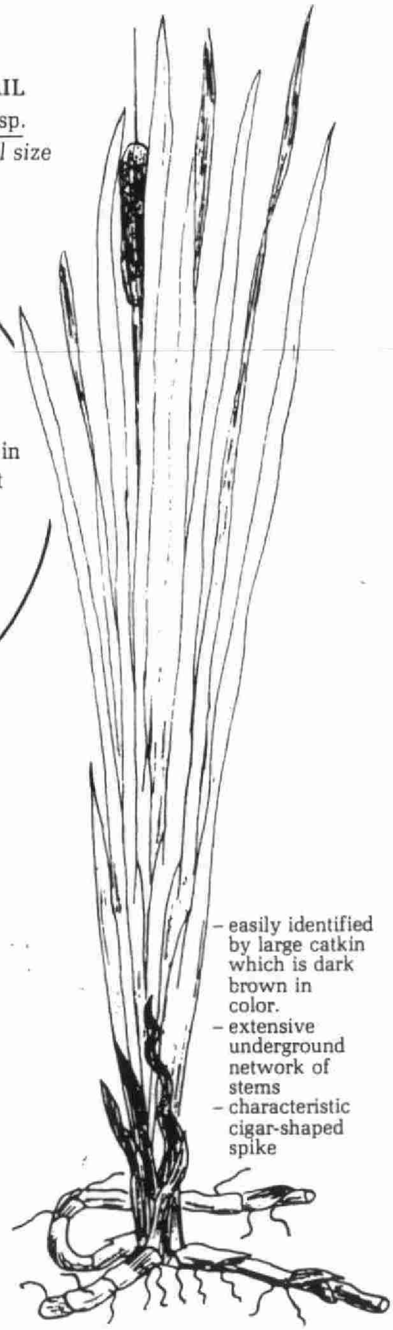


YELLOW WATER LILY OR SPATTERDOCK
Nuphar sp.
½ x *actual size*

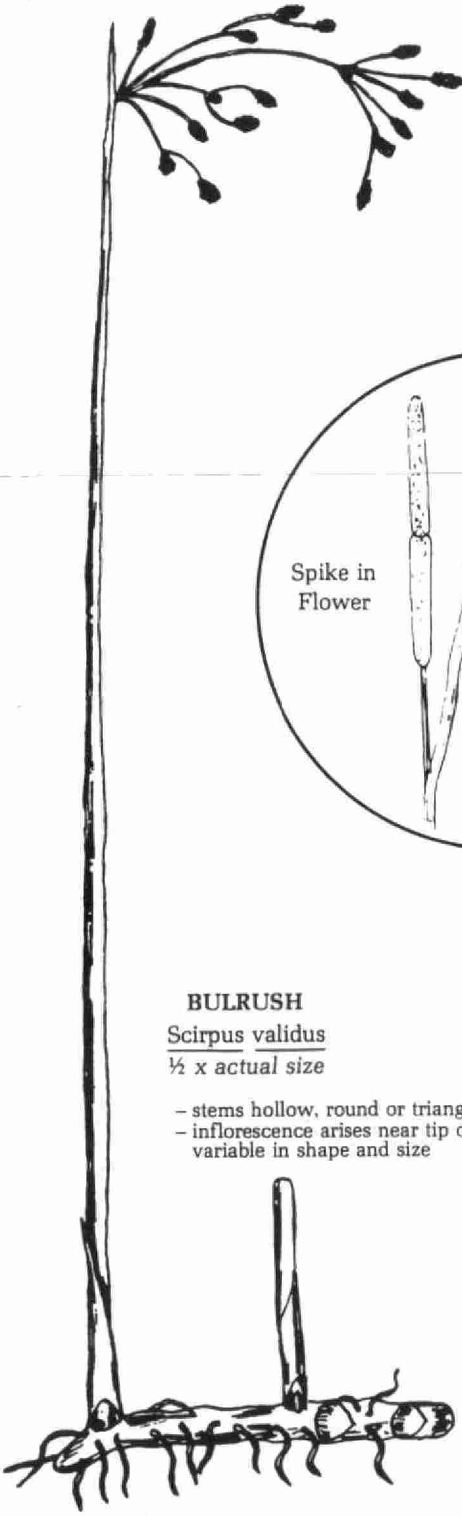
- leaf oblong
- flower yellow

CATTAIL
Typha sp.
⅓ x actual size





- easily identified by large catkin which is dark brown in color.
- extensive underground network of stems
- characteristic cigar-shaped spike



BULRUSH
Scirpus validus
½ x actual size

- stems hollow, round or triangular
- inflorescence arises near tip of stem, variable in shape and size

For current information on Aquatic Plant & Algae Control please contact:

Ministry of the Environment
Ontario

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Suite 100
Toronto, Ontario
M4V 1P5
Tel. (416) 965-2401

DATE DUE
